Wrexham glyndŵr UNIVERSITY

MODULE SPECIFICATION

Module Title:	**Engineering Mathematics**	**Level**:	4	**Credit Value**:	20

Module code:	ENG461	**Is this a new module?**	No	**Code of module being replaced**:	

Cost Centre:	GAAE	**JACS3 code**:	H100

Trimester(s) in which to be offered:	1, 2	**With effect from:**	September 17

School:	Applied Science, Computing & Engineering	**Module Leader:**	Maria Kochneva

Scheduled learning and teaching hours	60 hrs
Guided independent study	140 hrs
Placement	0 hrs
Module duration (total hours)	200 hrs

Programme(s) in which to be offered	Core	Option
BEng (Hons) Aeronautical and Mechanical Engineering	✓	☐
BEng (Hons) Mechanical Manufacturing	✓	☐
BEng (Hons) Automotive Engineering	✓	☐
BEng (Hons) Drone Technology and Operations	✓	☐
BEng (Hons) Renewable Energy and Sustainable Engineering	✓	☐
BEng (Hons) Electrical and Electronic Engineering	✓	☐
BEng (Hons) Applied Product Design	✓	☐
BEng (Hons) Automation Engineering	✓	☐
BEng (Hons) Optoelectronics and Holography	✓	☐
BEng (Hons) Aerospace and Modern Optics	✓	☐

Pre-requisites
None

Office use only

Initial approval February 17

APSC approval of modification — Version 1

Have any derogations received Academic Board approval? — Yes ✓ No ☐

Wrexham glyndŵr UNIVERSITY

MODULE SPECIFICATION

Module Aims
To provide a foundation of mathematical knowledge covering a wide range of basic topics and calculus; To develop an analytical approach to derivation of mathematical functions and expressions; To develop the application of mathematical principles in the solution of engineering problems, including by means of computer modelling software.

Intended Learning Outcomes

Key skills for employability

KS1	Written, oral and media communication skills
KS2	Leadership, team working and networking skills
KS3	Opportunity, creativity and problem solving skills
KS4	Information technology skills and digital literacy
KS5	Information management skills
KS6	Research skills
KS7	Intercultural and sustainability skills
KS8	Career management skills
KS9	Learning to learn (managing personal and professional development, self-management)
KS10	Numeracy

At the end of this module, students will be able to		Key Skills	
1	Use algebraic and trigonometric processes to derive and manipulate functions and equations, including scientific notation and significant figures.	KS1	KS3
		KS5	KS10
2	Plot graphs, including non-linear functions, and calculate their slopes and intercepts.	KS1	KS3
		KS5	KS10
3	Select and apply appropriate mathematical techniques to the solution of problems.	KS1	KS3
		KS5	KS10
4	Apply basic statistical analysis.	KS1	KS3
		KS5	KS10
5	Use differentiation and integration processes including second order differential equations.	KS1	KS3
		KS5	KS10
6	Use mathematical modelling software to apply mathematical techniques in solving engineering problems.	KS1	KS3
		KS10	KS4

Transferable/key skills and other attributes
To develop logical and mathematical argument; To improve learning and performance skills (e.g.: ability to organise study time, to study independently, to learn from feedback, and to meet deadlines); To develop skills for communicating mathematical ideas including the use of mathematical language and terminology in sentences; To be able to appreciate mathematical models of simple situations; To develop skills for using a computer algebra package in connection with mathematical problems; To interpret statistical data.

Derogations

A derogation from regulations has been approved for this programme which means that whilst the pass mark is 40% overall, each element of assessment (where there is more than one assessment) requires a minimum mark of 30%.
.

Assessment:

Assessment One: is by means of an exam covering outcomes 1, 2, and 3. It is an unseen time-constrained one with a fixed number of questions, typically five, where students are required to answer only three out of the five possible.

Assessment Two: is by means of an exam covering outcomes 4, 5, and 6. It is an unseen time-constrained one with a fixed number of questions, typically five, where students are required to answer only three out of the five possible.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)	Duration (if exam)	Word count (or equivalent if appropriate)
1	1,2,3	Examination	50	2 hrs	
2	4,5,6	Examination	50	2 hrs	

Learning and Teaching Strategies:

The calculus component of the module will be presented to the students through a specified series of lectures, supported by problem-solving practice carried out in interactive tutorials. These tutorials will be supported by practice using computer software both in tutorial time and by directed study outside the classroom.

Formative assessment takes place throughout the module during tutorials and feedback is given during these tutorials.

Syllabus outline:

Number systems: Numbers, place value, scientific notation and significant figures. Fractions. Use of calculator;

Algebra: Rules and manipulation of algebraic expressions. Language of derivation (and symbols). Solutions of equations. Introduction to polynomials;

Functions and Graphs:
Define function. Plotting and interpreting graphs. Slopes, intersection;

Trigonometric functions:

Powers: indices, exponentials and logarithms;

Graphs:
Linear graphs from non-linear functions;

Statistics:
Define and calculate numeric measures of average and spread.

Complex numbers: Different forms and arithmetic, DeMoivre's theorem, powers and roots, relation between trig and hyperbolic functions;

Vector algebra: Addition and subtraction, unit vectors, scalar and vector products;

Differentiation: Products, quotients, implicit and parametric differentiation, use of logs for complex products and quotients, applications;

Integration:
Methods of substitution, partial fractions and by parts. Definite indefinite integrals, applications;

First Order Differential equations: Linear first order differential equations; separation of variables, use of integrating factor. Second order with zero input - three types of solutions;

Second Order Differential Equations with Constant Coefficients: Method of undetermined coefficients for finding particular integrals. Transient and steady state solutions. Applications to damped vibrations and resonance. Introduction to finite difference methods for ordinary differential equations;

Applications: Contextualising the application of the topics considered in this module to make them relevant to the chosen technology specialism;

Software: Mathematical modelling software to support other elements of this module, emphasising potential as an analytical tool.

Bibliography:

Essential reading

Glyn, J. (2015) *Modern Engineering Mathematics*, 5th Edn, Prentice-Hall.

Other indicative reading

Bird, J. (2010) *Engineering Mathematics*, 6th Edn, Newnes.

Singh, K. (2011) *Engineering Mathematics through Applications*, 2nd Edn, Palgrave Macmillan.

Stroud, K. (2007) *Engineering Mathematics*, 6th Edn., Palgrave Macmillan

Key Website References:
Khan Academy: http://www.khanacademy.org/

Mathcentre: http://www.mathcentre.ac.uk/students/topics/